

SCIENCE

FRIDAY, OCTOBER 14, 1887.

IT IS UNDERSTOOD that General Greely has decided to discontinue the collection of marine data from masters of vessels, relying upon the Hydrographic Office to furnish whatever information may be needed in the work of his office. This change went into effect Oct. 1; and at the close of this year the Signal Service will discontinue also all work in connection with the international simultaneous meteorological observations, excepting so far as may be necessary to complete the publication of the results up to Jan. 1, 1888, thus bringing to a close a period of ten years' continuous observation. It is greatly to be hoped that the Hydrographic Office will make every effort to continue this very important work, and that Congress will authorize the further publication of the results in some such form as has been hitherto done, and so well done, by the Signal Service. The importance of this comparatively modern and only really scientific method of studying marine meteorology can hardly be overestimated. Indeed, if the vessels of all nations traversing the North Atlantic could be induced by the Hydrographic Office to take not merely one observation, but three simultaneous observations daily, corresponding in time to those taken at all our Signal Service stations, it could not fail to result in such an increase in the safety and certainty of navigation, in this the most important ocean on the globe to civilized man, as to make the expense and trouble involved wholly insignificant. The marine data collected by the Hydrographic Office are immediately utilized, so far as possible, in preparing the Mascart cablegram, sent to Europe every night by the Signal Service for the benefit of westward-bound vessels, and in compiling the 'Pilot Chart of the North Atlantic Ocean,' issued the first day of each month by the Hydrographic Office as a guide to navigation. In addition to this, all such data have, of course, a further, though less immediate, value as constituting the foundation upon which future progress in the study of ocean meteorology must be largely based. Here, as in every science, old observations and methods of work guide the way to further advances; so that, with improved instruments and methods, still greater practical benefits can be looked for. The results thus obtained can nowhere be of greater importance to mankind than in the North Atlantic Ocean, the great highway between the Old World and the New.

THE ATTENTION OF SANITARIANS throughout the country is centred on New York City and Tampa, Fla. At the former there arrived, Sept. 22, the steamship 'Alesia' from Naples, Italy, with four cases of cholera on board. During the voyage eight deaths had occurred from the same disease. The passengers were not permitted to come to the city, but were at once taken to the quarantine islands in the bay of New York. Since the debarkation other cases have occurred among the passengers. The lateness of the season will undoubtedly prevent any extension of the disease to the city this year. The presence of this dreaded disease in the port of New York, and the experience of past years in which the disease became epidemic in this country, should be a timely warning to all sanitary authorities. If cholera is to prevail in the United States during the coming year, it can hardly be expected to appear before spring, before which time at least six months will be available for purposes of a thorough cleansing and purifying of filthy spots in both city and country; and that community which neglects to take the necessary preparatory measures to cope with the disease must expect to reap the consequences. In connection with this subject it will not be

amiss to recall public attention to the recommendations which were adopted by the sanitary conference which met at Washington in 1884 in anticipation of the arrival of cholera during the following summer, from which we quote, under 'Health Matters,' in another column. As cholera at New York is attracting the attention of sanitarians, equally so is the possible existence of yellow-fever at Tampa, Fla. A telegram from the deputy-collector of Tampa to the Marine Hospital Bureau announces that there have been twenty-six cases of yellow-fever in that place; and the additional information is given that the doctors disagree as to whether the disease is dengue or yellow-fever. That doctors disagree is not a strange occurrence, and that this disagreement is in reference to the existence of yellow-fever is also no new thing. When undoubted yellow-fever appears in the South, its presence is always denied, and strenuous efforts are made by the local physicians to conceal it; so that to the recognized sanitary authorities must we look for a true statement of the nature of the disease which now prevails at Tampa. Thus far, nothing authoritative has been made public. Dengue prevailed in the West Indies in 1827, and in the following year made its appearance in the South. In the city of Charleston alone there were ten thousand cases, seven-tenths of the population being attacked. It appeared again in Charleston in 1850, and along the southern coast in 1880. It is commonly known as 'breakbone-fever,' from the fact that one stage of the disease is characterized by severe pains throughout the body. It commences with a feeling of chilliness, followed by fever, during which these pains are felt. Sometimes the joints in the hands and feet become swollen, as in rheumatism. Usually there is an eruption resembling measles. The affection lasts eight days, but a considerable time elapses before the strength of the patient is fully recovered. Some authorities regard the disease as contagious, while others deny it. A micrococcus has been described as being the germ of the disease, but this lacks confirmation. Fortunately dengue is not often fatal. In this respect it exhibits a marked contrast to yellow-fever, in which the mortality varies between ten and seventy-five per cent. La Roche states the average mortality to be 1 in 2.32.

NOTHING IS ATTRACTING more attention in agricultural circles just now than the great sorghum-sugar industry. The late results obtained at the experimental sorghum station at Fort Scott, Kan., are most encouraging, and have induced sanguine views of the future of the industry, which can only be compared with the dreams of the average land-speculator. As these views are somewhat amusing, we quote below liberally from one of our correspondents. "This is a great boon for Kansas and Missouri. There are enough acres of farm-land that will produce sorghum in Missouri and Kansas to make millionnaires of every man owning any quantity of land. It is said that the soil will produce from ten to fifteen tons per acre. One man can farm 50 acres of sorghum very comfortably. Fifty acres, yielding 10 tons per acre, is 500 tons of cane. From this the farmer gets \$250 worth of seed. The last run made at Fort Scott yielded 115 pounds of sugar to each ton of cane, which is 1,150 pounds per acre, or, for the 50 acres, 57,500 pounds. This, at the lowest figure possible, 5 cents per pound, is the snug sum of \$2,875. Besides this, there is a yield of 15 gallons of sirup to each ton of cane, making 150 gallons per acre, or 7,500 gallons for the 50 acres. This should sell for 20 cents per gallon, which is \$1,500 more, making the sum total of \$4,625 received from the 50 acres. After deducting the sum of \$1 per ton, the cost of milling, which is \$10 per acre, or \$500 for

the 50 acres, there is a net profit of \$4,125 from the acreage planted. This is clear net profit on the cane, and does not include any charge of profit to the people owning the mill or plant. Kansas has offered a premium of 2 cents a pound for all the sugar produced in that State, and there are 150,000 acres of sorghum grown there, and nearly a million dollars' worth of machinery has been built for experiments in testing the best manner of extracting the juices. Sorghum-sugar can be raised anywhere from the Gulf to Minnesota at less than 1 cent per pound; in fact, one of the sugar engineers of Cuba, after examining the results at Fort Scott, stated that he could put up a plant which would produce sorghum-sugar at 59 cents per hundred pounds. There is no reason why a bounty of \$500,000 a year should not be given to sugar, and as much more to flax, by the government. In thus co-operating with State experimental stations, an unexampled prosperity should result from these endeavors."

THE NICARAGUA CANAL.

ON April 24, 1887, the contract between the Nicaragua Canal Association and the Republic of Nicaragua was signed, and the work on this important route from the Atlantic to the Pacific will therefore soon be taken up.

The principal surveys of the route are those made by O. W. Childs, in 1850-54, on behalf of the American Atlantic and Pacific Ship Canal Company, and those of the United States Surveying Expeditions, 1872-73 and 1885, the former under Commander Hatfield and later under Commander Lull, the latter under A. G. Menocal, who was chief civil engineer of the expedition of 1872-73. Our map is compiled from the maps and profiles published in the reports of these expeditions, and shows the locations of the canal in 1872 and 1885.

Lake Nicaragua, which occupies the central part of the isthmus, will form the summit-level of the canal. Its outlet is the river San Juan, which flows to the Caribbean Sea. Near the lake the river is broad and flows through an open country. It has an average depth of nineteen feet. Twenty-eight miles below Fort San Carlos the river enters a hilly country and forms numerous rapids which obstruct navigation. The last of these are the Machuca Rapids, below which the river has a depth varying from 20 to 60 feet, with but little current: this section is called 'Agua Muerte,' or dead water. At the foot of the Agua Muerte the San Carlos is received into the river, and is the first considerable tributary. This river comes from a long distance up in the Costa Rica hills, and carries a considerable amount of detritus which consists chiefly of volcanic sands. Below the confluence the San Juan changes its character altogether, and is filled with shoals and sand-bars. An additional amount of detritus of a similar character is carried into the San Juan by the Serapiqui. While the upper course of the San Juan, which is almost exclusively fed by Lake Nicaragua, is not subject to freshets, its lower part, below the confluence of the San Carlos, partakes of the character of that river, which is a torrent during the rainy season, and has little water during the dry season. Therefore the lower part of the river cannot be made use of for navigation, and an independent canal to the Caribbean Sea must be built. In the location of 1872-73 the canal followed the river, and then crossed its delta to the lagoon of Greytown.

Thirteen miles below the confluence of the Serapiqui the delta of the San Juan begins. The principal arm of the river is the Rio Colorado, which flows to the eastward and empties into the sea. The other arm is the Lower San Juan, which passes more to the northward, and is divided into several mouths, which discharge their waters into the sea and into the lagoon of Greytown. The delta consists of the light volcanic sand carried into the San Juan by its southern tributaries. This silt has almost totally destroyed the harbor of Greytown by closing up the old entrance and filling a great part of the harbor. The silt is being carried into it by the Lower San Juan and the current. Therefore it is proposed to cut off the Lower San Juan, to send all the water through the Colorado into the sea, and to build a jetty for keeping the silt out of the harbor, which will be improved by dredging.

When the project of a canal through Nicaragua was first discussed, several routes from the lake to the Pacific Ocean were pro-

posed. The one advocated by Napoleon ran from the lake through the Rio Tipitapa to Lake Managua, and continued to the port of Realejo. This route, as well as those to Salinas Bay and San Juan del Sur, was found impracticable, and Brito at the mouth of the Rio Grande was chosen as terminus. The upper Rio Grande offers several difficulties on account of the freshets of the river and the narrowness of its valley. This induced Commander Lull to select the Rio del Medio route, though it requires deeper cuttings, as it avoids the upper part of the Rio Grande, while Menocal favors the Rio Lajas route.

The route proposed by Mr. Menocal extends from the harbor of San Juan del Norte, or Greytown, on the Caribbean Sea, to the port of Brito, on the Pacific, a total distance of 169.8 miles, of which 40.3 miles are canal in excavation, and 129.5 miles open navigation through Lake Nicaragua, the river San Juan, and the basin of the river San Francisco, a tributary of the San Juan. Lake Nicaragua, some 90 miles long by about 40 miles wide, the surface of which is 110 feet above sea-level, has been taken as the summit-level of the canal. Leaving the harbor of Brito, the canal follows the valley of the Rio Grande with a gradual inclination of about 12 feet to the mile, ascending by means of four locks, 26 to 29 feet lift, to the summit-level extending 8.5 miles west of the lake. From that point the canal extends easterly, and, cutting across the divide with a maximum depth of 41.4 feet above the surface of the water, reaches the lake 17.27 miles from the Pacific terminus. The summit of the divide cut through by the canal, 151.4 feet above sea-level, is much the lowest depression across the American isthmus.

The lake navigation extends from the mouth of the river Lajas to Fort San Carlos at the head of the river San Juan: through that distance not less than 28 feet of water can be carried to within 2,400 feet of the west shore, and eight miles of Fort San Carlos. For the former distance, dredging and rock excavation are necessary; and in the latter, dredging in mud to an average depth of 3.5 feet, to extend deep water from shore to shore. Other parts of the lake are very deep.

The canal then follows the river San Juan for a distance of 64 miles from the lake to Ochoa, just below the confluence of the river San Carlos (*v.* map). Here a dam is proposed, 1,255 feet long and 52 feet high, which will back the water of the river the entire distance to the lake, maintaining the surface of the latter at the proposed level of 110 feet. The upper part of the river thus deepened and widened will be converted into an extension of the lake, at no place less than 1,000 feet wide, and, with the exception of the first 28 miles from the lake, the depth gradually increases from 28 to 130 feet. Within those 28 miles, dredging and rock excavation to an average depth of 4 feet will be needed for a distance of 24 miles. The dam is located between rock abutments, and is proposed to be built of concrete resting on rock foundations 20 feet below the present water-level.

Just above the dam, a break between the hills confining the river on the north, affords a desirable basin at the entrance of the canal, which here leaves the river. After running a distance of .62 miles through the basin, it cuts across a broken country for a distance of 1.82 miles, and enters the valley of the creek San Francisco. This creek runs nearly parallel to the San Juan, from which it is separated by a range of hills, to a point about 9 miles from the dam, then, receiving a tributary from the north-east, turns abruptly to the south and empties into the San Juan. Its valley forms an irregular, flattened Y, with its foot resting on the San Juan, one arm extending westerly to within a short distance of the dam at Ochoa, the other easterly in the direction of Greytown. Across the stem of this Y will be built an embankment 6,500 feet long on the crest, with a maximum depth of 51 feet. This embankment will retain the waters of the San Francisco, forming an artificial lake of 30 to 50 feet depth, at the level of the river above the dam, or an extension of the summit-level. The outlines of this lake and the increase in width of the San Juan, after its waters are dammed up at Ochoa, are shown in our map according to information kindly furnished by Mr. Menocal. The extent of country which will be inundated by the San Carlos cannot be defined, as the valley has not been surveyed. As its character, however, is similar to that of the San Juan, the strip of

land will probably be very narrow. The necessary land will be granted by Costa Rica to the association. The canal route follows this deep basin to the western slope of the dividing ridge between the creek San Francisco and the river San Juanillo, 12.55 miles from the dam, and 19.48 from Greytown. Beginning at the eastern extremity of this basin, the canal cuts through the dividing ridge, the summit of which is 280 feet above sea-level, and in a distance of 14,200 feet, in which the average depth of the cutting is 119 feet above the water in the canal, strikes the eastern slope of the divide. This point is on the eastern terminus of the summit-level extending from the upper lock on the Pacific slope, a distance of 144.8 miles. Here it is proposed to carve in the solid rock, at the end of the deep cut referred to, the upper lock of the eastern branch, and drop the level of the canal 53 feet. The ground thence descends gradually to the next lock, .87 miles below, where another drop of 27 feet takes place; and the canal for a distance of about three miles is cut through a broad, slightly inclined valley to the third and last lock. This lock lowers the canal to the level of the sea, and from here it takes a direct course through the alluvial plains of the San Juanillo to the harbor of San Juan del Norte, or Greytown, a distance of 11.55 miles; from the last lock to Greytown on the east, and to Brito on the west side, the canal is enlarged, forming extensions of the harbors, where vessels can pass each other without detention. Ample provision has been made to protect the canal from surface drainage. Two basins are proposed at each lock where vessels can wait or pass each other without delay. The canal is proposed to be 80 feet wide at the bottom in deep cuts, and 120 feet in the terminal cuts and other enlarged sections; the width at the surface of the water being 80 feet in deep rock cuts, and 184, 288, and 342 feet at other points. The locks are estimated 650 feet long between mitre sills and 65 feet width of chamber. The estimated time of transit from sea to sea, on the basis of a speed of 5 miles per hour in the canal proper, 8 to 10 miles per hour in the river and lake, and 45 minutes' detention at each of the seven locks, is 30 hours. Allowing but one vessel to each lockage, 32 vessels in one day, or 11,680 in one year, can be passed through the canal. Breakwaters and dredging will be required at the harbors of Brito and Greytown to secure a free entrance.

It is estimated that the canal and its accessories can be completed in six years; and its cost, including 25 per cent for contingencies, is put down at \$64,043,697. The estimates are the result of an actual instrumental location of the entire line, and the surveys have been conducted with great care, and sufficiently in detail to insure a close estimate of cost.

The characteristic features of this location as compared to that of 1872-73 are the great extension of the summit-level eastward, which practically extends Lake Nicaragua to the divide between the San Francisco basin and the San Juanillo, by the high dam at Ochoa, and the embankment near the confluence of the San Francisco and San Juan, and the difference of the location of the upper part of the western division. Commander Lull recommended the Rio del Medio route, though it required cuttings of 134 feet, on account of better natural surface drainage, which is of the greatest importance for the stability of the work in a country with heavy rainfalls. On that line no water-course of considerable size would be taken in the canal, and, as its watershed is quite small, no fears were entertained of damages from freshets. On the Rio Lajas route the Rio Grande, a mountain stream of extensive and rapidly inclined watershed and precipitous channel, with a maximum flow of about 10,000 cubic feet per second, had to be passed. This difficulty has been overcome by Menocal by diverting it into the Juan Davila, a tributary of the Rio Lajas.

Dr. Polakowsky (*Petermann's Mittheilungen*, 1887, p. 138) raises several objections against this project, which, however, are not well founded. He says that it will be necessary to retain the present level of the San Carlos, as it would flood extensive parts of Costa Rica. This, however, cannot be true, as its course is very rapid, and as the lower part of its channel passes through a hilly country. Neither will the banks of the San Juan be flooded to any considerable extent, as may be seen from the accompanying map. The extent of land owned by private parties and required for the canal is very trifling, and therefore no considerable additional cost will be

occasioned by this item. The lands belonging to the state of Nicaragua will be given to the association without any compensation whatever. Besides the works belonging to the canal proper, the association is obliged by contract with the Republic of Nicaragua to establish a communication between the part of the San Juan not used for canal purposes and the canal by means of locks suitable for the navigation of ships of 6 feet draught, and another canal between Lake Managua and the lower part of the Tipitapa of sufficient dimensions to admit the passage of vessels drawing 6 feet, and of 150 feet length. The difference in level between the lakes is 22.34 feet. The river Tipitapa is shown in our map: it is full of rapids, and has a fall of 13 feet above the bridge of Tipitapa. This canal will be the property of the government.

Besides the land necessary for the construction of the canal, considerable land-grants are ceded to the company. On the left bank of the river San Juan from the Atlantic to Castillo Viejo it will receive alternate lots of three miles frontage and six miles in depth; from Castillo to the lake, on the south side of the river, lots two miles frontage and two miles depth; all along the south shore of the lake to the mouth of the Rio Lajas, lots of one mile square; on the northern bank of the Rio San Juan above Castillo, lots of three miles frontage and four miles in depth; and, continuing on the east shore of the lake as far as the river Tule, lots of two miles frontage on the lake and two miles depth are ceded to the company. Furthermore, it will receive forty lots of the existing public lands, each four miles frontage by five miles deep.

Though Menocal's plan is the result of frequent and thorough investigations, it is not considered as final, but the Canal Association intends to have the routes, and particularly the divides, resurveyed in the coming winter. Operations will be taken up in the present month. So far the geological features of the country traversed by the canal are still insufficiently known, and to these particular attention will be paid. From the specimens collected by Lull's and Menocal's expeditions, it appears that metamorphic rocks form the foundation of the eastern part of the country. Overlying these, volcanic lavas, such as very compact basalts, andesites, and rhyolites, were found. Borings will be made in all the localities where cuts are proposed. Particular attention will be paid to the eastern divide, as it is considered desirable to avoid the cutting of 119 feet above the water of the canal, if possible. The results of these surveys and borings will be laid before the leading engineers of North America and Europe, and not until then the final route will be adopted. It is hoped that thus unforeseen difficulties will be avoided.

The climate of Nicaragua is an important consideration, particularly while the canal is being constructed. The western part is undoubtedly healthy, while malaria prevails in the swampy delta of the San Juan. The following description of the climate by Von Franzius will be of interest.

In the north-eastern part of Central America the north-easterly trade-winds are the rainy winds from November until February. They lose their humidity on the eastern slope of the mountains, and reach the south-west side as dry winds. Particularly from November to January the trade-winds bring rain on the north-east side, in February and March rain is scarce, and in April there is none whatever. In the beginning the rain is even carried across the mountains to the south-western slope, where it extends a considerable distance down the valleys. Particularly in the saddles of the mountain ranges the rain extends south-westward. In November and December the rainy spells sometimes last for two or three weeks. They are called 'Navidades.' At the same season, when in October and November the north-easterly trade-winds make their first appearance and bring the first rain on the north-east side, the rainy season is at an end on the south-west side. The sky is clearing up, and the trade-winds begin to blow, at first squally, later on as a strong breeze. There are no thunder-storms during this season, which is called 'Verano.' The mountains are seen through a blue haze, while the air is very transparent and clear during the rainy season. The short period of calm weather crosses Central America twice, — first in March following the receding trade-winds, and then in October. The trade-winds reach the northern parts of Central America about the end of September. In the beginning of October they begin to blow in Guatemala, about the end

of October in Nicaragua, and in the beginning of November in Costa Rica and Panama. In Guatemala they blow from the middle of October until the end of April, in Costa Rica from the beginning of November until the end of March. At the end of this season, calms prevail for two or three weeks; then the south-westerly monsoon sets in, and tropical thunder-storms with heavy rains occur every day. This period begins in Panama and Costa Rica in April, in Nicaragua in May, and in Guatemala in June.

It is difficult to estimate the traffic that would make use of a canal through the American isthmus, as its opening would result in a complete revolution of trade. The route through the Suez Canal is taken by about two-thirds of the ships plying between Europe and Asia. According to C. Eggert the whole traffic of Europe with India, East Asia, and Australia, in 1883, required 5,707 ships of 7,773,658 tonnage.

From May 1, 1882, to April 30, 1883, 3,154 steamships, of 4,889,928 tons, and from May 1, 1883, to April 30, 1884, 3,407 steamships, of 5,585,504 tons, passed through the canal. Therefore it will be safe to suppose that in the beginning about two-thirds of the whole traffic which might avail itself of the American canal would make use of it. It may be that the figure will be a little lower, as some seamen will object to the locks of the canal, but this objection will readily be overcome. According to statements furnished by the Bureau of Statistics, the number and tonnage of vessels that could use a canal through Central America, amounted, in 1879, to 2,647 vessels, of 2,671,886 tons; in 1885, to 4,139 vessels, of 4,252,434 tons. From data furnished by the Statistical Bureau of Hamburg, the same traffic amounted, in 1883, to 2,404 vessels, of 2,337,346 tons. In these compilations the figures for the trade between the United States and foreign ports fairly agree, as the following table will show. The first line refers to vessels entered at and cleared from Atlantic coast ports of the United States in trade with foreign countries west of Cape Horn; the second, to vessels entered at and cleared from Pacific coast ports of the United States in trade with foreign countries east of Cape Horn. The first and third columns are according to the Bureau of Statistics of the Treasury Department; the second, from the Hamburg Bureau of Statistics.

	1879.		1883.		1885.	
	Vessels.	Tons.	Vessels.	Tons.	Vessels.	Tons.
1	273	247,567	462	462,767	721	734,236
2	455	551,929	629	792,180	714	957,784

The figures showing the trade between European ports and foreign countries other than the United States, and using the route around Cape Horn, do not agree as well:—

1879.		1883.		1885.	
Vessels.	Tons.	Vessels.	Tons.	Vessels.	Tons.
1,644	1,462,897	1,313	1,082,393	2,473	2,210,675

In the figures compiled from the data of the Hamburg Bureau the traffic between the Pacific and Atlantic ports of North America is not included; but there can be no doubt that this trade will rapidly develop after the opening of the canal, and that it will form one of the most important items of income of the canal. The United States Bureau of Statistics states that vessels of 4,252,434 tons might have passed the canal in 1885. If the increase should continue at the same rate, 6,506,214 tons might use the canal when opened, on Jan. 1, 1893. The Suez Canal route is used by two-thirds of the whole traffic; but it must be considered, that, on account of the winds of the Red Sea, sailing-ships cannot make use of the canal, while on the coast of Nicaragua the winds are more favorable. But, even if we suppose that from 70 to 80 per cent of the whole traffic will take this route, the income will be very considerable. Taking 70 per cent of the whole probable traffic of 1893 passing the canal, not less than about 4,700,000 tons would

take this route. But to this must be added the trade between the interior of the United States and eastern Asia, the greater part of which takes now the route of San Francisco, and part of the trans-continental trade; therefore it is probable that the figure is too low rather than too high.

The figures given above show that the tonnage of the vessels which will use this canal averages about 1,000 tons. Therefore the traffic would amount to about 3,500 vessels annually. The average tonnage, however, will rapidly increase after the canal is once open to navigation, as was the case with vessels passing the Suez Canal. The average tonnage of vessels passing that canal is given here:—

Years...	1870	1871	1872	1873	1874	1875	1876	1877	1878	1879	1880	1881	1882	1883
Tons...	898	995	1,073	1,166	1,290	1,345	1,377	1,419	1,425	1,533	1,510	1,517	1,587	1,747

This increase is due to the increase in the number of large steamers trading between Europe and Asia. The same will be the case after the opening of the Central American Canal. Though the navigation of the neighboring seas by sailing-vessels is not so difficult as that of the Red Sea, steamers will more and more monopolize the trade.

It is hardly possible to say which country will be most benefited by the opening of a canal through Central America. For the United States it is of the greatest importance, as it will open a new and important route from the Atlantic to the Pacific ports, as well as to the west coast of South America and to the islands and west shore of the Pacific Ocean.

DR. FRANZ BOAS.

SEARCH FOR GEMS AND PRECIOUS STONES.

THE insatiate desire for ornaments and articles to decorate the person, and hence the race for the acquisition of wealth, gives employment to thousands of persons in different parts of the world, who are kept busily engaged in searching for gems and precious stones; and in this aspect Prof. P. L. Simmonds considers it in a recent number of the *Journal of the Society of Arts*. It is somewhat difficult to know where the line of demarcation as to 'gems and precious stones' is to be drawn, and what properly come within this category; for tastes differ materially, and fashions change from time to time. About one or two, however, there can be no doubt as to classification. Diamonds and pearls have always been highly esteemed and appreciated, and the demand for these is universal. But there are some stones and substances that have value chiefly in special localities: such, for instance, as jade among the Chinese and Pacific Islanders, from its hardness and rarity; amber among the Chinese, Turks, and Russians; and coral among the East Indians, Chinese, and Africans. The African race appreciate the artificial Venetian beads above any valuable gem, because they have long been familiar to them, and are the fashion.

Precious stones have been prized in all ages for their portability, and high intrinsic value in a small compass. In Christopher Marlowe's celebrated play, 'The Rich Jew of Malta,' the merchant is represented as having before him

" Bags of fiery opals, sapphires, amethysts;
Jacinths, hard topaz, grass green emeralds,
Beauteous rubies, sparkling diamonds,
And sold seen costly stones of so great price,
As one of them, indifferently rated,
And of a carat of this quality,
May serve, in peril of calamity,
To ransom great kings from captivity.
This is the ware wherein consists my wealth!"

A glance over the various regions of the globe will show us men of all races, in large companies, delving in the ground or diving in the sea for this commercial wealth. Indeed, scarcely a sea or a river but has its fleet of boats at certain seasons laden with men eagerly searching for pearls, although it is chiefly in the tropics that these boats congregate. It may prove interesting to gather a few facts connected with this important quest, taking the searchers on land first, and then investigating the rich produce gathered from the sea.

In the Indian Empire there is a great commerce carried on in gems and precious stones, although no reliable data are available,

as they are so portable, and there is no absolute necessity for records being kept. The Indian trade-returns of the last three years give the value of the imports at an average of £200,000. A large trade is carried on in them to Sewistan, Kashmir, Ladakh, Thibet, Nepal, Sikkim, Upper Burma, Siam, and Karennee. There is no doubt that through private sources four or five times the reputed values are brought in, and also exported each year to Europe.

There are in India three extensive tracts, widely separated from one another, in which the diamond has been sought for. The name of Golconda, originally applied to a capital town (now a deserted fort in the neighborhood of Hyderabad), seems to have been used for a whole kingdom; but the town itself is many miles distant from the nearest diamond-mines, and it was only the mart where the precious stones were bought and sold. The second great tract occupies an immense area between the Mahanuda and the Godavary Rivers; and the third great tract is situated in Bundelcund, near the capital of which — Punnah — some of the mines are found. For those content with a slowly paying occupation, and a hard life involving close supervision of the workers, diamond-mining will pay, provided such persons possess capital sufficient to last them a few years. The diamonds now are usually brought from Partaal, close to the southern portion of the Nizam's dominions. The deepest pits are not more than twelve feet. The matrix of the diamond in those localities is a conglomerate sandstone. The appliances of modern machinery for excavation, etc., directed by men of science, may possibly bring to light gems that have not been discovered by the rude native processes of search.

It would be curious to ascertain the yield of diamonds in the East from those mines in the last three hundred and fifty years, and of Brazil in the last one hundred and fifty years since the discovery there; but no such data are obtainable, nor indeed can any reliable estimate be formed of the value of the diamonds owned in different countries. In the United States, diamonds to the value of £1,700,000 were imported in 1886. Two million and a half carats of diamonds are cut yearly in Amsterdam. Precious stones being free of duty in the chief European countries, no records are obtainable. The Brazilian mines are said to yield about £800,000 of diamonds, and India, Borneo, and Australia, £200,000; but these sums are insignificant now, in comparison with the South African yield of about £4,000,000 yearly.

The only Indian mines now worked for diamonds are the northern ones in Bundelcund. The produce, between £40,000 and £60,000, is sold locally, and only about 100 carats are sent to Europe. Diamonds have been found in Sumatra and Celebes, but Borneo alone now produces a regular supply, sending, it is computed, about 3,000 carats annually into the European market. The discovery of Cape diamonds has reduced the Brazilian mining to a minimum of about 24,000 carats. And here it may be desirable to explain what this fanciful diamond weight is. The diamond grain is equal to about four-fifths of a troy grain, hence four diamond grains are equal to one carat, or 3.174 troy grains. But, as half the rough stone has to be cut away in polishing, to estimate the value of a rough diamond we must ascertain its weight in carats, double that weight, and multiply the square of this product by £2, which may be taken as the average price of rough diamonds that are worth cutting. Formerly, indeed, the price of diamonds was as the square of their weight; but this rule no longer holds good, as their value mainly depends upon quality.

From the four principal mines in Griqualand (which all lie within a circle with a diameter of three miles), calculating the amount of diamondiferous ground removed, and the known average yield per load in each, it is found that not less than 33,000,000 carats of diamonds (or more than $6\frac{1}{2}$ tons weight) must have been extracted since the first discovery; realizing, in round numbers, £40,000,000 sterling.

The yield of diamonds from the Kimberley mine alone, from the opening in 1871 to the end of 1885, is stated to have exceeded 17,500,000 carats, equal to $3\frac{1}{2}$ tons weight of precious stones, in value about £20,000,000.

To obtain this, as many thousand tons of reef and ground have had to be excavated. The mine is 450 feet deep, and the cubical contents of this huge cavity measures about 9,000,000 cubic yards. Four thousand Kaffirs are employed at this mine, and more than

20,000 natives of Africa arrive yearly at the mines in search of work; so that the employment of native labor and the development of native trade are incidental benefits conferred on South Africa by the discovery of the diamond-fields.

The Dutch Government are the owners of the diamond-mines in Borneo, which are situated in the district of Landak, in the territory of Ponteyanak: they are worked by Dyaks and Malays, but with far superior skill by the Chinese. The gems are found in a yellow-colored gravel, at depths ranging to 60 feet. Advances are made to the miners, who are bound to deliver all stones at 20 per cent below their market-value.

Diamond-mining in New South Wales is likely to become of much importance, and the colonists are sanguine of being able to compete with South Africa in this trade. Twelve thousand diamonds have been obtained up to the present time, chiefly from the tertiary gravels and recent drifts in the Bingera, Inverell, and Chit-tagong districts. The largest diamond yet found weighed 16.2 grains, or about $5\frac{3}{8}$ carats. They are of good color and quality. Companies with large capital are forming to buy up and work the extensive diamond-fields in Bingera. Other gem stones found in that colony are garnets, the common emerald (green beryl), Oriental emerald (green sapphire), royal blue sapphire, white and pale-blue topaz, and agates.

The ruby-mines of Burma, when scientifically worked, are destined to yield a vastly increased quantity of this precious stone. There has been lately a sharp competition for the lease of these mines from the British Government, and it is believed that Messrs. Streeter have secured the right for £40,000. It is creditable to England that they have such enterprising firms of jewellers, seeking the produce at the very sources of production, as is evidenced by their explorations in South Africa, their employment of fleets of boats and divers for pearl-fishing round the Australian shores, and competition against Indian and Continental firms for the Burma ruby-mines. Rubies are of various reds, and the red sapphire or Oriental ruby is next in value to the diamond.

It has been well observed that digging for gems, like all gambling speculations, is but too attractive, and great numbers of the rural population in Ceylon and elsewhere neglect the safer pursuits of agriculture for the speculative profits of the gem-pits.

Ceylon has always had a reputation for its richness in precious stones. Inferior kinds, such as the moonstone and the garnet, are found in the beds of streams about Kandy, Newara Eleya, Badulla, and some of the small rivers of the south; but the more precious stones, such as the ruby, the blue sapphire, the Oriental topaz of various yellows, the Alexandrite, and the cat's eye, must be sought within a radius of thirty or forty miles from Ratnapura, the city of gems.

The Ceylon ruby is more frequently of a rich rose color, having considerably more light and life than its Pegu rival, and is preferred by many Orientals to the pigeon-blood ruby, which, although the more costly stone, is invariably less brilliant than the Ceylon one.

The search for gem stones is carried on in the most primitive manner in Ceylon. The soil supposed to be rich in precious stones is rented for an annual sum from the government. Coolies are set to work to dig the earth, which is heaped up on one side, and then washed through a trough with variously sized perforated zinc stops, which retain all stones, according to their sizes. These are placed on a table or flat surface, and the gems are easily distinguished and picked out. The proportion of gems capable of being cut and really marketable is not more than 1 per cent.

Of the siliceous gems, the amethyst, of a purplish violet hue, is the most valuable. The best amethysts are brought from Cam-bay in India, and from Siberia, Ceylon, and Persia, where they are found both lining the cavities of geodes and in rolled masses. The chief supply of the blue turquoise is drawn from the peninsula of Sinai, the great mining district of the ancient Egyptians.

Among the Moors, rubies and emeralds, generally uncut, are worn set in finger-rings and huge ear-rings, and necklaces of amber and coral are also prized. The Moors consider that the risk of fraud by imitation is lessened by not having precious stones submitted to the art of the lapidary. This taste for keeping gems in the rough also prevails among many of the Indian princes.

In 1879, thousands of British subjects from Burma passed through Bangkok on their way to the sapphire-mines of Siam. The unhealthy condition of the place proved fatal to numbers, and, although many realized great profits, the rush soon abated. No royalty was charged on the gems found, but a poll-tax of six shillings was levied at the mines. A sapphire weighing 370 carats in the rough, and 111 when cut, was the largest known to have been found. The ruby, onyx, and jade are also found in this district, but the quality of none of these is such as to make them very valuable.

Year by year great changes occur in the intrinsic value of precious stones from frequent plentiful discoveries. The great find of sapphires in Kashmir and Siam reduced their value some 50 per cent. The discovery of large deposits of amethysts in the interior of Brazil caused 7,000 diamond-washers to abandon their usual calling and flock to the neighborhood of the city of Caeté, but the prices dropped so rapidly that the shipments made did not pay. The diamond market has not been materially affected by any great fall in price from the enormous production in South Africa.

Art has much to do with the manufacture of gem stones. Chalcedony, when stained by metallic oxides, rises to the dignity of a gem stone, as sard, carnelian, chrysoprase, when uniformly tinted brown, yellow, or green; as agate, onyx, sardonyx, when the colors lie in bands or strata. The dull or latent colors are developed by heat or roasting. Black onyx, that is, black stones crossed by bands of pure white, are always artificial.

The precious opal was formerly in high repute, but has gone out of fashion from being considered unlucky, — 'misfortune's stone,' — and yet nothing can be more beautiful than the opals of Hungary and Queensland. The fine collection of the latter was much admired at the recent Colonial Exhibition. The area in which opals are met with in Queensland is large, but only in one or two localities are opals of any value obtained. They are remarkable for their brilliancy and variety of color, rivalling in that respect those of Hungary. The ultramarine blue color so finely shown in the Queensland specimens is rare even in Hungary. They are obtained of considerable size, and are of good value. Of other gems, there have been found in Queensland, diamonds, rubies, sapphires, topazes, etc., in the tin-bearing drift of Stanthorpe. Agates, which are also employed as burnishers, are met with in large quantities in the Agate Creek, Etheridge gold-field. There they can be procured in all colors and sizes by the hundredweight.

In the opal-mines of Dubreck, Hungary, about two miles of galleries are worked under government supervision, yielding a revenue of £1,200. The opal-bearing rock is not disposed in vein or bed form: on the contrary, the precious stone is found in nests, or pockets, and it not unfrequently happens that a considerable distance may be passed in the workings without showing a sign of an opal.

Like some of their more civilized brethren, the Maories of New Zealand are passionately fond of adorning their persons with trinkets and other ornaments, especially of jade. At the present day many of the decorations formerly used have been discontinued. Ear-ornaments are still in general use: they are worn by both sexes, and are of great variety. Those of greenstone, or nephrite, are the most highly prized. The amulet, or neck ornament, is generally of greenstone, carved into the resemblance of a human figure. The image is not unlike a Hindu idol, having an enormous face and badly shaped legs of disproportionate size. The ear pendants of greenstone vary in form: some are narrow pieces, from 3 to 5 inches in length, and others are round, thin, and flat. The color of jade varies from almost white to a dark green, but the lighter shades of green are the most highly prized. It is hunted for in the fissures of the precipices and in the streams of Chinese Tartary. Much of it is found in the rivers there by divers. These men work by moonlight, under an escort of soldiers, supervised by government officers appointed for the purpose, and by whom each piece, as found, is assayed and valued. The imperial jade is of a brilliant green, approaching the emerald in color.

There are jade-quarries in Burma, situated in the Mojaung district, at the head waters of the Churdwen, about 90 miles from Bhamo. They are leased to two companies for £6,000, and the trade is entirely in the hands of the Chinese.

The imports of jade into India are to the value of £30,000 to £40,000. In India jade vases are often ornamented with jewels, or carved and wrought so as to form elegant devices. The old Delhi work in cut and gem-incrusted jade is priceless. The Chinese had cut jade for ages, but never ornamented it except by sculpture; but, when it was introduced into India, the native jewellers, with their quick eye for color, at once saw what a perfect ground it afforded for mounting precious stones, and they were the first to incrust them on jade. The Indian Museum at South Kensington possesses the choicest and grandest specimens of this work known, of the best Mogol period (Sir G. Birdwood on 'The Industrial Arts of India').

Blocks of green stone, axes, meres, charms, and other articles of jade, were shown in the New Zealand Court of the late Colonial Exhibition, evidencing the patient skill of the Maoris in working this hard material, second in this respect to the diamond, although nevertheless somewhat fragile.

Passing now from land to sea, we shall find the busy search as actively carried on. In the coral-fishery of the Mediterranean nearly 600 boats are employed, manned by about 6,000 men, the number to a boat varying from 6 to 12 hands. They are sent out from Torra del Greco, Leghorn, Liguria, Sardinia, and the Algerian ports. It is a curious sight to see a fleet of these boats, ranging in size from 3 to 14 tons, employed on the banks with their wooden windlass amidships, hauling up what is termed the 'engine,' a kind of cross-shaped dredge for tearing off the branches of coral from the rocks. About 400,000 pounds of rough coral are brought in annually to Italy; and the shaping and working of this into the varied forms it assumes for commercial purposes, gives employment to hundreds in the chief cities. The value of the coral shipped from Europe used to reach about £600,000 annually; but with the change of fashion this has declined considerably. Not long ago there was quite a rage for the pale flesh-colored coral for jewelry. Coral ornaments may again come into fashion, even if they do not fetch the high prices at which they were formerly sold. Coral has the hardness and brilliancy of agate: it polishes like gems, and shines like garnet, with the tint of the ruby. In Russia, northern Africa, and India, coral is still much in demand. The imports into India last year were to the value of £20,000.

Amber was one of the most valuable jewels of antiquity. It was endowed with manifold sympathetic effects as a talisman against rheumatism, toothache, and other complaints. The Turks still believe it to be an infallible guard against the injurious effects of nicotine: hence its extensive use for the mouthpieces of pipes. Amber is esteemed for ornaments by many. The cloudy, or milk-white, and the opaque lemon-colored, are the varieties most valued by connoisseurs. The imports to this country are to the value of about £3,000 to £4,000, but it is largely shipped also to Austria, France, Turkey, and the Eastern nations. It is principally obtained on the Prussian coast of the Baltic, from Dantzic to Memel. At one establishment near Memel dredging is carried on day and night by 'shifts' of men, 400 being so engaged. At another, in Königsberg, 2,350 persons and nineteen steam-engines are employed. The pits are 300 feet deep, and 100 carts are employed on the works. In other localities divers are employed, two to each boat, with submarine clothing and air-pumps.

The fishing for pearls and mother-of-pearl shells is carried on in very many quarters: in Lower California, the coasts of Mexico, the Bay of Panama; in the Red Sea, the Persian Gulf, Ceylon, Borneo, New Guinea, the Sooloo Isles, Fiji, the Society and other of the Pacific Islands, and on the east and west coasts of Australia. The pearl-fisheries on the coasts of Central America furnish about £100,000 worth of pearls, and employ about 1,000 divers. Our imports of pearls average in value about £100,000: France receives about the same. The marketable value of pearls is much higher in Asiatic countries than elsewhere: hence the best are sent to Bombay, where fancy prices are often given for good pearls.

At the Bahrein fishery in the Persian Gulf, many hundred boats are employed, manned by from eight to twenty men, and the value of the pearls obtained is stated to average £1,000 yearly, but this amount of course varies. The larger and more valuable pearls are believed to be sold secretly. The men receive two-thirds of the catch, after deducting expenses, and for food, etc.

The great pearl-fishery of Ceylon is carried on at stated periods on the banks of the north-west coast of the island, at the entrance to the Gulf of Manaar. As it is a government monopoly, great care is now taken to give rest to the fishery, so as to allow the oysters to attain a maturity of five or six years, which will warrant a rich yield of pearls. There is a prospect of a good pearl-fishery in 1888; and it is confidently expected that as many as 300,000,000 oysters will be fished, requiring every boat and every diver procurable in Ceylon and southern India. The small, thin shells of this oyster (*Avicula fucata*), unlike the heavy, true mother-of-pearl oyster (*Meleagrina margaritifera*), have little or no commercial value, and are chiefly burnt for lime.

When a fishery is proclaimed, the arid sands at Arippe, on the north-west coast, become, as it were, a bustling town of tents, filled with people of varied races and occupations, including boatmen from the Coromandel coast, pearl-dealers from India, Malaya, and China, with the accompaniments of merchants and traders of all classes. The Ceylon Government takes as royalty two-thirds of the oysters gathered, which are sold by auction at the close of each day's fishing. Only a limited number of boats and divers are licensed to fish.

The fishing can be carried on only during the very calmest period of the north-east monsoon, — February to April. In these months the wind blows off the land during the night, and off the sea during the day, which enables the large fleet of fishing-boats to reach the pearl banks by daylight on each morning, returning with their cargoes shortly after noon. The boats, containing twenty men (half divers), are divided into two fleets, which go out to their work on alternate days. The price realized for the oysters varies from £2 to £7 the thousand, the value depending to a great extent on that of a sample of 5,000 lifted in the early part of the fishing. The contents of the mollusk being allowed to decay before the pearls can be obtained, the stench is horrible. The congregations of pearl-dealers, petty traders, official subordinates, and laborers on the shores, are enormous.

About the island of Borneo there is a good deal of fishing for pearls, which are found in a thin, flat, pinkish-shelled oyster, known locally as *salesiep*. This lives only in shallow brackish water at the mouths of rivers. Several boats rendezvous at the same time and place to frighten the crocodiles and sharks. Twenty or thirty persons will be in the water at once, diving, splashing, laughing, and shouting, and bringing up three or four shells at a time: extra yells from all hands salute a rather larger find than usual. Very few of the pearls obtained are of any value individually: they are chiefly seed-pearls, which are sent to China, where they are pounded up, made into powder, and this is swallowed by ladies who desire to improve their complexion; at least, such is the story. From British North Borneo the value of the pearls exported in a year is £500. Pearls of a very high price are not infrequently to be bought at Sandakar, but they come principally from the islands of the Sooloo Archipelago. The largest ever seen there was valued at £1,600.

The formation of pearls is not limited to the bivalves: they are produced on several univalves, especially on the *Strombs* and *Turbinellas*, but are more rare in these than in the bivalves. About the Bahamas group of islands and keys, the shells of the king, queen, and common conch were much sought after for sale to the cameo-cutter, but the fashion for cameo jewelry has passed away. The common conch is the ordinary pink-mouthed shell so frequently seen in milk-shops. It furnishes the rare pink pearls, so much appreciated, and these are exported from the Bahamas to the value of about £3,000 annually. Some fine collections of these pink pearls, set and unset, were shown at the Fisheries and Colonial Exhibitions in London.

It was once thought that no other pearls than those produced by the pearl oysters could obtain a rank among gems; but some of the river-pearls found in species of mussels (*Unios*) compete closely with those from the *Mollusca* of the ocean. These river-pearls are found widely diffused in France, Saxony, Bavaria, Bohemia, and Silesia, as well as in the lochs and rivers of Scotland, Ireland, and Wales. In China, the rivers of Manchuria furnish a good many. Delegates from the royal household look out for the best of these pearls there for the ladies of the imperial court.

In many of the Scotch rivers old men, women, and children may

be seen wading about the shallow fords; and, when they discover a collection of mussels, they thrust down long sticks split at the ends, and bring up the mussels wedged in the slots. In the shallow waters of the Dee, the boatmen look down into the water with a tin having a glass bottom, and when shells are discovered, they are brought up by a kind of dredge, or scoop, and frequently some fine pearls are obtained.

These pearl mussels are also found in most of the small streams of the Province of Quebec, and in the districts bordering on the lower St. Lawrence. The streams most abounding in pearl mussels are but little known, except to Indians and backwoodsmen, who are careful in guarding the secret of where these mollusks are found.

Occasionally a party of pearl-seekers may be seen paddling in a bark canoe, and portaging through a very wild region. After opening several thousand mussels, they will only succeed in securing a few good pearls. These vary in color from white to dark brown: the white are appreciated for their rarity, and the pink on account of their peculiar brilliancy. In form they are generally round or spherical, and have a hard skin with an iridescent or nacreous hue.

It would lead to too much detail to pass under review the various pearl-fisheries of the Australian coasts, the Eastern Archipelago, and the Pacific Islands, where the unclothed native divers have to brave the attacks of sharks, cephalopods, and other dangers. They especially dread the stings of the jelly-fish, which they say are speedy death to them. Enough has, however, been stated to show the importance of this wide-spreading industry of hunting for gems and precious stones. Fine collections of these are frequently brought before the public to feast their eyes on, as at the recent Colonial and Indian Exhibitions in London, and those at Amsterdam, Paris, and elsewhere.

At the Fisheries Exhibition in London, a firm of Parisian jewellers showed, among others, a very choice five-row necklace of 355 selected Oriental pearls, weighing 2,570 grains; a matchless and unique necklace and parure of Scotch pearls; a very important black pearl necklace, composed of 39 pearls, weighing 1,020 grains; a round pearl of 96 grains, being one of the finest pearls known, and worth £20 a grain; a very important collection of Oriental pearls, composed of 3,345 grains original, such as are most prized in Bombay, besides black, pink, yellow, and gray fancy pearls.

MENTAL SCIENCE.

Recent Observations in Hypnotism.

THE great attractiveness that the study of the varied and interesting phenomena of hypnotism possesses for the French physicians has been often noticed. Not a month passes without some new and often startling contribution. The leaders in this movement are eminent scientific specialists, and have been cautious about accepting all the strange doings of excitable subjects as perfectly genuine. They appreciate the readiness with which a shrewd patient can deceive the unsuspecting observer, and insist upon the most exacting tests, arranged with a full knowledge of the sources of error to be eliminated. Under such a scrutiny, many alleged marvels have taken on a less miraculous aspect, and many startling interpretations shown to lack validity. Amongst the oldest claimants to scientific recognition in this field is the statement that a magnet has a peculiar effect upon hypnotic subjects. Sometimes the application of a magnet causes trembling and tingling; again it is said to produce contractions of limbs, and cause such a contraction to pass from one side of the body to the other; and so on. Professor Delboeuf, a successful observer in this field, has very ingeniously tested these claims, and made much progress towards showing their falsity. He experimented upon a boy of fourteen, an experienced hypnotic subject susceptible to 'magnetic' influence. In the preliminary trials Professor Delboeuf had a true magnet and a wooden magnet made to look alike, and each fitting in a case alike for both magnets. He handed the boy the case containing the true magnet, but nothing happened: as soon as the magnet was drawn out, he developed a violent contracture, his usual symptom.

Next, Professor Delboeuf had three steel bars made exactly alike, two of which were strongly magnetized, and the third not. He gave the boy a real magnet, and asked him whether he felt any thing. After an exploring glance of from thirty to forty seconds, the boy felt tingling sensations, then pain and the usual symptoms. The same was done with the other hand, and he was shown that the bar was a real magnet. Professor Delboeuf then drew the false magnet from his pocket and gave it to the boy: no effect followed. Then the third (true) magnet was given him, with the request that he should say whether it was a magnet or not. No contraction followed; and from now on, the boy had no clew as to the true or the false magnet. Fourteen trials were made, consisting simply in giving the boy a bar, and noting the result. In eleven of these trials he either exhibited the contraction when holding the false magnet, or failed to exhibit it when holding a true one; thus showing most conclusively that all the effects were self-induced, and suggested by his belief that a magnet was being applied. The same was repeated with another subject, with a like result.

Professor Delboeuf similarly tested the powers of the hypnoscope, which is simply a small hollow magnet to be held on the finger, and, when thus giving rise to peculiar sensations, is claimed to show that the holder is a good hypnotic subject. Three hypnoscopes were made exactly alike, only two of which were magnetized. Of fifteen university students, three claimed to feel glowing sensations from the instrument, and one of these felt it all the way up to the shoulder. Strangely enough, this young man held the false hypnoscope, and on trial proved to be the best subject. The conclusion drawn is, that the hypnoscope is useful in detecting hypnotic subjects, not because of any magnetic sensibility, but because persons of such a susceptible temperament as to imagine sensations from it furnish one of the chief requisites for passing into this condition.

Dr. Voisin indorses this same general view. He has repeated the noted Paris observations, in which the mere approach of an hermetically sealed vial containing a certain drug affects the hypnotized subject in the same way as a strong dose of the substance in the normal state. He finds that if the utmost precautions against talking to his assistants, and other modes of suggesting the expected effect, are taken, the result is negative, and concludes that in his subject a wonderfully shrewd appreciation of suggestions accounts for all that was exhibited. He finds, too, that the application of a magnet unknown to the subject had no effect, while she is extremely sensitive when she knows a magnet is about.

Dr. Bernheim has described some remarkable cases in which the mere suggestion of a certain idea in the waking state serves to impress this idea with a lifelike reality. His subjects are young men of neurotic temperaments in their ordinary waking condition. One patient was told that a certain physician attacked him on the street and picked his pocket. He at once accepted the tale, added details of time and place, and no amount of questioning would get him to give up the notion. Turning to another patient, Dr. Bernheim asked whether he knew any thing about it. The suggestion was sufficient. The subject of the attack had told the second patient all about it in the morning, and so on. The same delusion was passed on to several patients, and accepted. These observations show a connection between what occurs in the hypnotic state and the phenomena observed in weak-willed persons. The possession by a dominant idea imposed by another or suggested by circumstances is the common mark of many of these semi-abnormal states. They also show how easily such people can be utilized for base purposes; and Dr. Bernheim believes that the son of the sexton in the famous Tisza-Esler affair (who claimed to have seen through the keyhole the cruelties on which the trial was founded) was a case in point.

In this connection it may be added that there is a growing sense of the great danger to which this subject is liable at the hands of amateurs. Examples of its pernicious effects in individual cases are accumulating, and a most celebrated French alienist recently expressed himself thus: "Hypnotization is not as harmless as it has been made out to be: the hypnotic state is closely allied to the hysterical neurosis, and, like the latter, it may in some cases become markedly contagious. If medicine in the name of science and art has taken possession of hypnotism, it should keep it within the

strict limits of its own domain, using it as a powerful therapeutic agent, and never letting it pass into profane hands, where it is liable to be abused to the detriment of the public health.

HEALTH MATTERS.

Precautions against Cholera.

IN view of the possibility of an attack of cholera during the coming year, we deem it appropriate to quote below from the recommendations of the sanitary conference held at Washington in 1884, in anticipation of the arrival of cholera:—

First, That all surface wells should be closed at the earliest possible moment, and that great care should be taken that the water-supply of all cities, towns, and villages shall be of undoubted purity.

Second, That all privy-vaults should be abolished wherever water-closets can be supplied, and that, wherever the existence of such vaults is necessary, they should be rendered water-tight in such a manner as to prevent the saturation, not only of the ground surrounding them, but also of the materials of which they are built, and that the contents of such vaults should be kept constantly disinfected, and removed to a proper place at frequent intervals.

Third, That all stagnant ponds, when practicable, should be disinfected, and when possible the water removed by drainage or pumping, and the further accumulation prevented by filling with fresh earth, or other material free from garbage or other filth.

Fourth, That great care should be exercised to keep at all times clear and free from obstruction all sewers into which passes the refuse from dwellings, factories, and other buildings, and that such examinations should be made as will detect imperfect plumbing in all buildings, and the defects immediately corrected. In this connection special attention is directed to the necessity for the thorough ventilation of all soil and waste pipes, and to the dangers connected with untrapped and unflushed soil-waste and overflow-pipes.

Fifth, That extraordinary care should be exercised in reference to all tenement-houses, lodging-houses, and in general all places where large numbers of human beings congregate; that no accumulation of garbage or other filth be permitted in cellars or yards; and that frequent and thorough cleaning and whitewashing of such structures be required; and that householders should frequently and thoroughly examine their yards, cellars, closets, and other out-of-the-way places, to see that no filth of any kind has been deposited there.

Sixth, That the food-supply be vigorously watched to exclude from the market all unwholesome meat, all milk adulterated or from diseased animals, and all unripe fruits and vegetables; and that cow-stables be kept at all times clean, well whitewashed, and free from all excremental accumulations.

Seventh, That all garbage, kitchen and household refuse, should be promptly removed from dwellings, stores, and other buildings, to a proper place, where it may be destroyed by fire, or otherwise disposed of in such manner as to occasion no nuisance.

Eighth, That such material should never be used in the filling of lots, or disposed of by throwing the same in streets or vacant property, where it may decompose and exhale offensive and deleterious gases.

Ninth, That the attention of the authorities of all institutions, both public and private, and of individuals as well, be drawn to the great importance of maintaining a habit of personal cleanliness in the persons under their charge, as being one of the most efficient means of warding off an attack of cholera, or, if it has once appeared, of greatly reducing its virulence and fatality.

Tenth, Should the cholera appear in any place in this country, the health authorities of the place should have immediate notice of the first cases, in order that prompt action may be taken for complete isolation and disinfection.

Eleventh, That all authorities of states, cities, or villages be urged to adopt measures which will result in the amelioration of all conditions such as have been referred to in the foregoing propositions, with the warning, that, in the opinion of this conference, such conditions, if permitted to continue, will greatly promote the spread of cholera when it comes, and with the assurance, that, if requisite

measures are promptly taken to remove them, the disease will be less likely to attack a community so prepared, and, if attacked, such a community will be better able to cope with the disease and to reduce its ravages to a minimum.

PUBLIC HEALTH ASSOCIATION.—The American Public Health Association will hold its fifteenth annual meeting at Memphis, Tenn., on Nov. 8, 9, 10, and 11. The following topics have been selected by the executive committee for consideration at the meeting: 1. The pollution of water-supplies; 2. The disposal of refuse matter of cities; 3. The disposal of refuse matter of villages, summer-resorts, and isolated tenements; 4. Animal diseases dangerous to man. The president, Dr. George M. Sternberg, will in his address refer to the results of his investigation of yellow-fever in Brazil and Mexico. In view of the possible existence of this disease at Tampa, Fla., referred to elsewhere, this subject will be of absorbing interest. The committee on disinfectants will present a report embodying the researches and experimental work of that committee during the past year. Clergymen, teachers, engineers, architects, builders, and all interested in the practical work of the association, are cordially invited to be present.

EXPLORATION AND TRAVEL.

Manchuria.

IN *Science* of May 6, 1887, we mentioned the journey of three enterprising Englishmen through Manchuria. In a lecture delivered before the Royal Geographical Society of London, Mr. James, one of the travellers, gave a sketch of the country they traversed, from which we take the following notes: The most interesting part of the journey was that in the Chang Pai Shan (the 'Long White Mountains'). These were supposed to be more than 10,000 feet high, but the measurements of the travellers show that the loftiest peak is not more than 8,025 feet high. They are supposed to be sacred to the ancestors of the reigning dynasty of China, and it is sacrilege to trespass on them. Nevertheless the country has been rapidly settled in recent times. The colonists have formed themselves into associations or guilds for protecting their life and property against robbers, who infest all parts of Manchuria; and in this they have been so successful that their territory is the only one enjoying perfect security. Here the travellers learned that the highest peak of the mountains is the Lao Pai Shan (or 'Old White Mountain'). The road to this point led through thick forests and over bogs which were absolutely impassable for any beast of burden whatsoever: therefore they had to leave their mules behind, and continue their march by foot. The peak rises from a grassy plateau dotted with trees, through which subterranean streams make their way. The ascent to the summit was not very difficult; and here a crater 350 feet deep was found, at the bottom of which there was a beautiful blue lake, from which, according to the legend, the Manchurians sprang. The white color of the mountain is due to the color of the disintegrated pumice of which it consists. The principal rivers of Manchuria have their source in the Chang Pai Shan.

THE WELLE.—We may expect that the problem of the Welle, which has baffled geographers for a long time, will soon be solved. *Le Mouvement Geographique* says that the government of the Kongo Free State has charged Captain Van Gèle with the exploration of this river. The results of Van Gèle's ascent of the Obangi in the 'Henry Reed' are shown in the sketch-map in *Science*, No. 233. As the rapids of this river hindered his further progress, another route had to be adopted, and Van Gèle has decided to take that of the Itimbiri (Lubi). The sketch-map shows that the rapids of the Lubi are only about thirty miles distant from the Welle, and that Junker's Alikobo, the most western point reached by him, is only a few days' march from that point. Van Gèle's expedition started on July 1, in the 'Henry Reed' and 'A. I. A.', to ascend the Lubi, and proposed to cross the country in a north-westerly direction. Having reached the Welle, he intended to follow it to its mouth, and thus to ascertain whether it is identical with the Obangi or not.

DELAGOA BAY.—Consul H. E. O'Neill gives some interesting information on the state of affairs in Delagoa Bay in the August number of the Proceedings of the Royal Geographical Society. As

two important routes to the mining districts of Transvaal start from Delagoa Bay, the latter place has gained considerable importance. Though it belongs to the Portuguese, British trade is rapidly extending over this part of the coast. Upon the roads from Lorenzo Marques, which is situated on Delagoa Bay, to the interior, Englishmen are establishing themselves, and begin to monopolize the trade with the Swazi country. Over the inner frontier English gold-diggers are advancing into Portuguese territory, and many claims have already been registered in the secretariat of the government of Lorenzo Marques. The natives form one of the chief channels for the spread of English influences throughout this district. They work for a number of years in the English colonies, and then return with what money they have earned. Thus English money has become the currency of the country. The Portuguese are working on a railway from Lorenzo Marques to Barberton; but the work is advancing very slowly, and it will probably be a long time before it will be completed. Delagoa Bay is the first point at which actual contact has taken place between the British and Portuguese in South Africa; and it will be interesting to see how the latter, who have confined themselves for more than three centuries to the shores of the bay, will resist, or adapt themselves to, the vigorous life that characterizes the former.

THE SAMOA ISLANDS.—It will be remembered that in 1886 the United States, England, and Germany sent special commissioners to the Samoa Islands in order to settle the troubles that had arisen from the lively competition of these nations. It was proposed to submit the report of this commission to a conference. The Samoan troubles date from the attempt of the German Government to grant a subvention to a German firm which had plantations in Samoa. At that time the Americans, particularly Colonel Steinberger, made strenuous efforts to give a firm basis to the American influence on the islands, and made a treaty with King Malietoa. The Germans made a treaty with the same king in 1884, while the British consul tried to bring about an annexation of the islands by the colony of New Zealand. In course of time King Malietoa began to favor the Americans, and therefore the Germans supported his adversary, Tamasese. A short time ago the Germans, while the work of the commissioners was still going on, sent four men-of-war to Apia in order to demand compensation for certain plunderings. As Malietoa refused to pay, five hundred men were landed, and Tamasese was declared king of Samoa. Malietoa, who first intended to resist, followed the advice of the American and British consul, and submitted. It has been said that it is proposed to divide the islands among the three powers, but this seems improbable. The islands are at the present time of great importance, but this will be still more the case when the canal through the American isthmus is open, as they form an important station between Australia and America.

BOOK-REVIEWS.

The Social Question. BY J. H. OERTER. New York, E. Glaeser.

DR. OERTER has produced a small volume on the social question, which is all the more interesting because it is from the hand of a theologian. It does not derive any special authority from this fact, but it is indicative of what that profession is beginning to realize in its capacity of public teaching. It signifies the ultimate, although perhaps gradual, emancipation from traditional speculations that have no relation to the present sphere of human conduct and duty. Theological speculation, like poetry, may have a place in our fancies and ideals; it may even exercise a very wholesome influence in stimulating thought and action upon higher planes: but it must not set itself up for fact, nor ignore the existence of facts. No class of teachers needs a knowledge of social questions, facts, and forces more than the ministry, and we are glad to know that the number is increasing of those who find time and interest for studies vital to the moral growth of the future. Dr. Oerter's book is one of a number which enable us to measure the possibilities of the ministerial profession in forwarding the cool consideration of scientific facts. Dr. Strong's 'Our Country,' although a missionary appeal, and Heber Newton's 'Study of Social Questions,' form a kind of companion issue with this in point of general thought. They are not large and thorough treatises from men who have

nothing else to do, but they show a very healthy development among a body of men who can more than hold the balance of moral and social power in the world, if only they have the knowledge on the one hand, and the courage on the other, to improve their opportunities.

Christianity in its inception was a moral and social reform, and not a body of dogmatic and traditional beliefs about either the past or the future. The foremost of the ministry are beginning to see this, and to return to the original conception of it, by what one author candidly though forcibly admits to be "in one sense a *backward* movement." Much is to be hoped for in this tendency, and it is worth recording here as a generous welcome to those who can appreciate the force and value of scientific truth, abandon their diatribes against science, and fall into line with the inevitable course of history, which usually has an optimistic outcome, unless nature has to avenge itself for the systematic pursuit of error and wrong.

The volume under notice consists of the 'Vedder Lectures' at New Brunswick Theological Seminary; and the keynote to the discussion is well expressed in the reason assigned for the present revolutionary tendencies, that "the actual inequality of possessions is regarded by the great mass as standing in direct opposition to the generally acknowledged equality of the individual rights of all men." In former times men did not have their equality or their rights admitted, and hence neither arguments nor force could avail to defend them. The author shows from Bockh that three-fourths of the population of Greece were excluded from the benefit and protection of the law; from Gibbon that one-half the population of Rome consisted of slaves, and that not more than 13.5 per cent of the population of Attica possessed real estate. The concentration of power which such a system required was enormous, and no wonder the liberation of the masses from its abuse is accompanied with alarming symptoms. But it is a pleasure to see the ministry recognizing the scientific methods of studying such facts, and not relying upon their speculations about baptism, inspiration, and the trinity to regenerate society. The author wisely treats socialism, whether legitimate or not, as an effect, a phenomenon to be accounted for, something having a cause for its existence, and not to be gotten rid of until its causes were removed. True to his profession, the views of the Old and New Testaments upon property are briefly outlined and candidly handled; but he frankly admits that "any attempt to construe out of passages of the New Testament a specific Christian idea of *property*, will always fail." This is not to exclude ethical from all relation with economical questions. It is acknowledged that we must reckon with the selfish instincts of human nature in all schemes of social government, at least until those instincts are modified. The discussion of the principles of Ricardo and the so-called 'Manchester school' is fair; and more is sympathetically narrated of Proudhon, Fourier, Karl Marx, Lasalle, Louis Blanc, and the whole history of socialistic movements, than most men of theological propensities have the will to read. But there is no disposition to espouse the vagaries of those men, although their agitation and beliefs receive the acknowledgment of being scientific facts which have to be studied.

The solution of the problem is a very good chapter, as admitting the place of ethical considerations along with economical in deciding the issue of the question. Here the author has the opportunity for urging the Christian aspects of the case, which is done in a way quite foreign to the usual homiletic method. It is made a purely scientific question of ethics and political economy. We cannot agree with him, however, that the socialism which he condemns has its support in atheism, and must be destroyed by uprooting the latter. It is a re-action against the traditional method of solving social and moral problems. The age of authority is past, and nothing but facts with reasoned scientific truth based upon them can meet the exigencies of the case. Atheism has its evils, but it will be harder to overthrow this than the system of socialism.

Brief Institutes of General History. By E. BENJAMIN ANDREWS. Boston, Silver, Rogers, & Co. 12°.

WE do not remember having seen any book which is of so much service to the advanced student of general history as this. As a guide to *seminar* work in history, it would be of the greatest value. It is dedicated to Professor Todl of Breslau, whose 'Geschichte

der Ethik' is well known to our students of philosophy; and there is no lack of congruity between the work itself and its dedication to a philosopher, for it is eminently philosophical, both in scope and in treatment. Professor Andrews calls his book a 'precipitate of general history,' and this describes it excellently. It is not an outline, and it is not a skeleton, but 'precipitate' seems to us a very happy designation.

The body of the work falls into eleven chapters, the first dealing with history and the study of history, and the last with Prussia and the New Empire. Each chapter is subdivided into short sections or paragraphs, and each of the latter is accompanied by bibliographical references of great minuteness and accuracy. In this way the student is enabled to hunt down any particular period or episode with great ease, and post himself fully before proceeding. Then each chapter is preceded by an elaborate and more general bibliography, the preparation of which shows wide reading and scholarly research.

The full value of Professor Andrews's volume cannot be appreciated by a cursory examination. We are sure that its excellence of arrangement and treatment will be seen best when it is in use. As a guide to the scientific study of history, or as a skeleton for *seminar* work, it is not surpassed by any book in the language.

Nystrom's Pocket-Book of Mechanics and Engineering. Revised by W. D. MARKS. Philadelphia, Lippincott. 24°.

AS the author remarked in his first preface, every engineer should make his own pocket-book, as he proceeds in study and practice, to suit his particular business. This work was accumulated in this way during the author's professional career, and was first placed before the public in 1854. The reviser has principally confined himself to corrections in the original text, but has added an elementary article on dynamic electricity, and also one on the expansion of steam; and in notes the reviser has taken occasion to express some differences of opinion, and has referred to the literature of topics which required more space than can be given to them in a pocket-book.

Elements of Analytical Mechanics. By PETER S. MICHIE. New York, Wiley. 8°.

THIS volume, as the preface states, is a revised edition of the text taught to the cadets of the United States Military Academy during the session of 1886-87. Together with a brief chapter on hydrodynamics, it is intended to comprise a four-months' course of instruction for students well versed in elementary mathematics. The subjects treated of, after the elementary chapters on matter, force, motion, the physical units, stresses and motive forces, and gravity, are those usually taken up in a treatise on this subject. The book closes with a theory of machines. The arrangement of the subject-matter, and method of treatment adopted, are such as have received the approval of several able scientific officers who have been associated with the author in the instruction of cadets.

On the Conversion of Heat into Work. By WILLIAM ANDERSON. New York, Van Nostrand. 12°.

THE Council of the Society of Arts invited the author of this work to deliver a course of lectures upon the conversion of heat into useful work; and these lectures, which form the basis of the present work, were delivered in the winter of 1884-85. The object of the lectures was to popularize the doctrine that in heat-engines the work given out is due to the conversion of the molecular motion of heat into the visible motion which it was desired to produce, and further to illustrate, by numerous practical examples, the applicability of the doctrine of Carnot to defining the limits within which improvement in the economical working of heat-engines was possible. In the hope of making the modern views with respect to the action of heat more real and practical, the author adopted the method of working out his investigations by means of numerical examples, and comparing the results with those obtained in actual practice. All those who are interested in the elementary instruction

of physics will find this book an extremely valuable aid, and full of suggestions. The chapters on other forms of heat-engines besides the ordinary steam-engine tend to make the subject more interesting, and place in the hands of the teacher a vast amount of important information.

The Elements of Qualitative Analysis. By WILLIAM A. NOYES. Terre Haute, Ind., Moore & Lanzen. 12°.

PROFESSOR NOYES'S little book on qualitative chemical analysis is a very brief and highly condensed account of ordinary modes of proceeding in qualitative analysis of a simple kind, and the reasons therefor. Of the properties of the elements considered, only such are discussed as are immediately applicable to the scheme of analysis, though the deficiency in this respect is supplied to a certain extent in the table of re-actions, for which the author acknowledges indebtedness to Biedermann's 'Chemiker-Kalender' for 1887. Of course, such a book may serve profitably as the foundation merely, upon which the judicious instructor erects the superstructure of his teaching, and for such use it will doubtless find place. It is clearly written and well arranged.

Elements of Modern Chemistry. By ADOLPHE WURTZ. 3d Amer. ed. Tr. and ed. by W. H. GREENE. Philadelphia, Lippincott. 12°.

THE appearance of the third American edition of this well-known and excellent text-book bears witness to its popularity. The present edition is based upon the fifth French edition, and is brought well down to date.

Quantitative Chemical Analysis by Electrolysis. According to original methods, by DR. ALEXANDER CLASSEN. Tr. by WILLIAM H. HERRICK. New York, Wiley. 8°.

It is perhaps not unnatural that an author who is also an investigator should attribute to methods of his own finding greater importance than he is inclined to yield to the devices of others. Upon some such presumption only does it seem possible to explain the presence of the phrase 'according to original methods' upon the titlepage of Professor Classen's book. Scarcely more than half the fundamental methods of electrolytical analysis which are described or referred to are the author's own; and even in the schemes for the separation of elements, and in the special applications, where the original methods are employed to the utmost possible extent (and sometimes, it is to be feared, to the exclusion of more suitable ones), recourse has been had in fully a fourth of the cases discussed to the processes of others. For many years a few electrolytical methods have held high rank, and justly, among precise analytical processes, and recently the number of such has increased. To note that these are recognized (though too scantily) in the text, if not on the titlepage, is gratifying. Professor Classen has rendered great and undoubted service to analytical chemistry in arousing and directing attention to the uses of electricity in chemical analysis; but stress of severe experience (to detail which would be out of place here) compels the suggestion with reference to some, at least, of the 'original methods' that, before applying them in work demanding close accuracy of results, to scrutinize carefully and test by experiment is the part of wisdom.

Elementary Trigonometry. By T. ROACH. Oxford, Clarendon Pr. 12°.

THIS work on elementary trigonometry is the result of many years' experience in teaching the subject, both as assistant master in Repton School and as a private tutor. The book-work is divided into short portions, and at the end of each portion is introduced a set of examples illustrating the point just taught. The total number of examples in the text is more than a thousand, and to these is added a graduated collection of two hundred miscellaneous questions. The author expresses a hope to include a collection of more difficult questions on the same part of the subject in a subsequent work on higher trigonometry. At the end of the book is given a collection of papers recently set in some of the principal examinations in England, in which a knowledge of elementary trigonometry is required.

NOTES AND NEWS.

THE interior department of Canada has received advices from the exploratory survey party sent to northern British Columbia, near the Alaska boundary-line. Dr. Dawson, who is in charge, will return to Ottawa before winter sets in. The other section of the expedition, under the direction of Mr. Ogilvie, has been gathering general information regarding the country, and making a general survey. Considerable data have been gathered regarding the disputed boundary-line between the Dominion and Alaska. This, when completed, will be transmitted to Ottawa, when diplomacy will settle the boundary question. Mr. Ogilvie proposed to winter near Fort Reliance, a point about one thousand miles north of Victoria. After obtaining more men, he will endeavor to penetrate across country as far north as the mouth of the Mackenzie. His proposal to increase his party is simply a precautionary measure, as he was informed that the Eskimos on the Arctic slopes are very troublesome. He will start for home by another route, ascending the Mackenzie River, and entering civilization in the North-west Territory. He expects to reach Ottawa next fall.

— The Canadian Government is making an effort to settle the troubles at Metlakatla, which were mentioned in the last number of *Science*. Mr. A. Vankoughnet, deputy minister of Indian affairs, left on Oct. 4 for British Columbia. He has been intrusted with the task of investigating the troubles among the Metlakatla Indians, who are removing to Alaska. Bishop Sillitoe of New Westminster, British Columbia, has for the past week been the guest of Sir John A. Macdonald, the Canadian premier. It is understood that he visited Ottawa specially to urge the government to back down with the hope of persuading the Indians to remain on British soil.

— The Nautical Society of Hamburg has offered a prize of 500 marks for the best essay on the subject of calming the sea by the use of oil. An exhaustive description of experiments of the effect of oil made up to the present time is required; also a criticism of the arrangements used so far, and especially complete directions for its use by large steamers and sailing-vessels, as well as small vessels, — pilot, fishing, and life-saving boats, — besides directions for the use of oil at sea and near the coast. The essays are to be written in English or German, and sent before Nov. 1, 1887, to the president of the Nautical Society, director of the Navigation School, Capt. F. E. Matthiesen, Hamburg. Competition is not limited by nationality.

— According to *Nature*, the Syndics of the Cambridge University Press will publish early in October two works on elementary chemistry. One, intended as a companion to lecture-work, is by Mr. Pattison Muir and Dr. Charles Slater; the other, intended to be used along with the book already mentioned, is a course of laboratory work by Mr. Pattison Muir and Mr. Carnegie. Both books deal with the subject of elementary chemistry in a manner somewhat different from that usually adopted in text-books.

— Bulletin No. 35 of the United States Geological Survey, on the physical properties of the iron carburets, by Carl Barus and Vincent Strouhal, is a continuation of the work published in Nos. 14 and 27, and the investigation is still incomplete. This contribution is devoted to the internal structure of tempered steel, and the color-effect produced by slow oxidation of iron carburets. Bulletin No. 36, on the subsidence of fine solid particles in liquids, by Carl Barus, has a more obvious bearing on the proper work of the Geological Survey, since this and kindred investigations have already thrown much light upon the process of sedimentation.

— The 'Digest of the International Law of the United States,' which has been prepared by Dr. Francis Wharton and issued from the government printing-office in three volumes, is a splendid work. The able editor has brought together a most valuable collection of material, and arranged it in excellent order. This work will long remain our standard reference-book on topics of international law.

— The number of steamers existing in the world last year is estimated, says the *Journal of the Society of Arts*, at 9,969, of an aggregate burthen of 10,531,843 tons. The corresponding number of steamers existing in the world in 1885 was estimated at 9,642, of an aggregate burthen of 10,291,241 tons. The total of 9,969 steamers, representing the world's steam-shipping in 1886, was made up as follows: iron steamers, 8,198, of an aggregate burthen of 8,911,406 tons; steel steamers, 770, of an aggregate burthen of 1,206,962

tons; composite steamers, 109, of an aggregate burthen of 32,820 tons; and wooden steamers, 822, of an aggregate burthen of 380,655 tons. Of the steamers afloat in 1885, 5,792 were owned by the United Kingdom and its colonies, their aggregate burthen being 6,595,871 tons. The other countries of the world owned steamers as follows, last year: Germany, 579; France, 509; Spain, 401; the United States, 400; Norway, 287; Russia, 212; Denmark, 200; Italy, 173; Holland, 152; Brazil, 141; Japan, 105; Greece and Turkey, 82 each; Belgium, 68; Chili and the Argentine Republic, 43 each; China and Portugal, 27 each; Hawaii, 21; Mexico, 15; and miscellaneous, 50. It will be seen, that, notwithstanding the great depression prevailing in steam-shipping, the number of steamers afloat has increased to the extent of 327, as compared with 1885.

—The official returns quoted from the *Wochenschrift für Brauerei* for the first six months of the current year show the export of a total weight of 64,079 tons, being an excess of 2,789 tons as compared with the same period of 1886, but representing a decrease of 13,281 tons as against the first six months of 1885. There has been a progressive export during the earlier part of the last three years to Hamburg, Bremen, Austria, Switzerland, and Sweden, while deliveries to France and Belgium have fallen off. There is an increase this year in exports to Holland and Denmark. Trade with Great Britain and Russia has been larger than in 1886, although not up to the mark of 1885; while there is a decrease in shipments to the United States, Italy, and Spain, as compared with 1886. Imports from Austria were for the three six-monthly periods,

was dug up. Four of them are nearly same size, — about seven inches long, one and a half inches wide at broadest place, and about one-fourth of an inch in thickness along the middle line. The fifth is half an inch shorter, one and one-fourth inches in greatest breadth, and nearly half an inch thick. It is hardly so well finished as the other four.

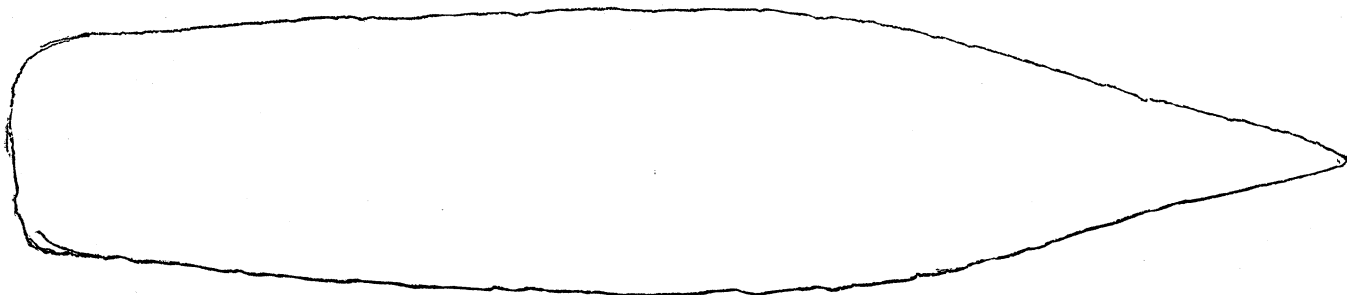
When found, they were all lying close together, their flat sides in contact, and points up, evidently so placed intentionally. They were buried about two feet below the surface of the ground. They are now in my possession.

J. W. KILPATRICK.

Fayette, Mo., Sept. 30.

Over-Pressure in the Schools.

I THINK it is an unfortunate fact that our public-school system is not elastic enough to mould itself to the needs of the individual. Grades are a necessity in it, and grades must be quite rigidly fixed. But I think that the parents can mould the system so that there shall be no over-pressure. A great source of trouble is that the parents often positively encourage the pressure. A mother brought to me her daughter, a shamefully overworked high-school scholar; no exercise, except the walk to and from school. If this mother takes my advice, and sends word to the teacher, "My daughter is not going to stand at the head of her class any more; if necessary, she will be honestly and healthily at the foot," the teacher may reply, "Then she cannot graduate, and have a diploma." Then the mother must mould the public-school system to her daughter's needs, and say, "Then she will not graduate. I am content to have



STONE DAGGER FROM MISSOURI.

5,433, 6,236, and 6,829 tons; and from Great Britain, 404, 441, and 504 tons. Thus it will be seen imports have, on the whole, been increasing. The imports from Austria have always been much in excess of the exports to that country, but formerly imports from Great Britain were inferior in quantity to the direct exports thither. The quantities were as nearly as possible equalized during the period under review, but it is conjectured that a portion of the beer nominally exported to the Hamburg district was subsequently forwarded to England.

LETTERS TO THE EDITOR.

* * * The attention of scientific men is called to the advantages of the correspondence columns of SCIENCE for placing promptly on record brief preliminary notices of their investigations. Twenty copies of the number containing his communication will be furnished free to any correspondent on request.

The editor will be glad to publish any queries consonant with the character of the journal.

Correspondents are requested to be as brief as possible. The writer's name is in all cases required as proof of good faith.

Stone 'Daggers' from Missouri.

THE following may be worth recording. A few days since, near this place, a farmer, digging to make a pond, in land that has never been under cultivation, found a 'deposit' of five chipped stone 'daggers' (or spear-heads?). I enclose an outline sketch of one the exact size of the specimen. The 'daggers' are of chert, and so much alike in material, that one can easily suppose them made from pieces of the same mass of stone. The workmanship, as indicated by the finish of the implements, is of superior merit. Each implement is chipped to a sharp edge all around, even at the base. They are all in perfect condition except No. 2, which received small breaks on one side of base and at extreme tip of point as it

it so." Perhaps she will not say this, for parental pride is one cause of the over-pressure.

Another cause is parental laziness. It is easy to keep a boy employed evenings by compelling him to stay at home and study his lessons. Otherwise he must either be allowed to choose his own amusement, in the house or out of it (which, of course, is not the best thing), or the parents must have him on their minds, and provide amusements for him, or at least have an oversight of his recreations, which is a trouble. In practice, too many parents either let their children roam the streets at night, or beg the teacher to give their children enough to do, so that they must have some lessons to occupy their evenings.

E. P. KING.

Providence, R.I., Oct. 8.

Silver in Oregon.

I FIND silver in minute quantities in several of the eruptive rocks of north-western Oregon. The upper lava-flows on the Portland Hills contain, as far as I have investigated them, amounts ranging from one-tenth of an ounce per ton (or .000034 of one per cent) to one-fourth of an ounce (or .000085 of one per cent). The lava in question is a scoriaceous micro-basalt, very much decomposed in the exposed portions, but becoming sound and hard at a few feet depth.

Specimens of volcanic tufa from an immense deposit in the western foot-hills of the Cascade Range, near the Clackamas River, yield from a 'trace' of silver up to the surprising quantity of six ounces per ton (or .0002 of one per cent).

In the assays I employed the scorification method, using test lead devoid of silver.

HERBERT LANG.

Portland, Ore., Sept. 30.